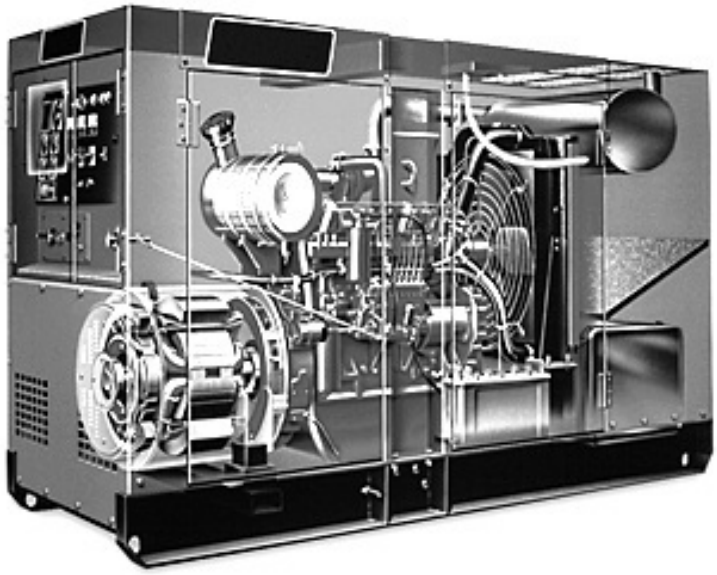
# SERVICE TRAINING

MULTIQUIP ®



# DCA GENERATOR TROUBLESHOOTING GUIDE

○ TROUBLESHOOTING ○

Manual No. DCATRBLSHOOT

# CALIFORNIA

## Proposition 65 Warning:

Engine exhaust and some of its constituents, and some dust created by power sanding, sawing, grinding, drilling and other construction activities contains chemicals known to the State of California to cause cancer, birth defects and other reproductive harm.

**Some examples of these chemicals are:**

- Lead and lead-based paint.
- Crystalline silica from bricks.
- Cement and other masonry products.
- Arsenic and chromium from chemically treated lumber.

Your risk from these exposures varies, depending on how often you do this type of work. To reduce your exposure to these chemicals: ALWAYS work in a well ventilated area, and work with approved safety equipment, such as dust mask that are specially designed to filter out microscopic particles.

# IMPORTANT!

Read the operator's manual for safety instructions before you attempt to troubleshoot. Use extreme caution when troubleshooting power equipment. Never start or run power equipment inside a closed area, breathing exhaust fumes can kill.

Basically, a tool is an object that enables you to take advantage of the laws of physics and mechanics in such a way that you can seriously injure yourself.

This training manual is intended to provide information and procedures to safely troubleshoot and give a basic understanding of troubleshooting techniques for the DCA series generators.

You must be familiar with the operations of the DCA series generator before attempting to troubleshoot or make repairs. Basic operating and maintenance procedures are described in the operation and parts manual supplied with the generator. Use the supplied manual to order replacement parts. If you are missing the operation and parts manual, please contact Multiquip Inc to order a replacement or you may visit our website at www.multiquip.com

For your safety and the safety of others carefully read, understand and observe all instruction described in this manual.

**Safety precautions should be followed at all times when servicing equipment. Consult operations manual for more safety information**

THIS GUIDE IS USED FOR TRAINING PURPOSE ONLY AND NOT FOR GENERAL DISTRIBUTION

# SAFETY

**PLEASE REMEMBER SAFETY FIRST!!!!!!!!!!!!!**

This troubleshooting guide emphasizes safety precautions necessary during operation and testing. Safety precautions should be followed at all times when operating, maintaining and testing power equipment. Failure to read and understand safety precautions and warnings could result in injury to yourself and others.

PLEASE READ ALL SAFETY PRECAUSIONS AND WARNINGS LISTED IN THE SECTION MARKED SAFETY BEFORE OPERATING, SERVICNG OR TESTING THIS EQUIPMENT.

If you are not sure of the instructions or procedures, seek qualified help before continuing.

This manual is not intended to be a substitute for properly trained personnel. Repairs should only be attempted by qualified, trained technicians. Each installation, application and operations of generators can create its own set of circumstances. No manual can cover every possible situation. When in doubt, ask. There is no such thing as dumb questions. BE SAFE!!!!!!!

The following tests should only be carried out by qualified and/or experienced technician who have received SAFETY TRAINING ON LIVE EQUIPMENT.

All test instruments and their leads / connectors / probes must be checked to ensure that they are suitable for the voltage levels being tested, and are in good working order.

Whenever the generator is running, always assume and proceed as if voltage is present at the generator leads and at the regulator panel connections. Caution must be observed. Otherwise, serious personal injury or death can result.

Before any work is done, and testing is conducted appropriate measure should be taken to prevent unexpected start-up of the generator.

**ALWAYS DISABLE ENGINE BEFORE WORKING INSIDE A GENERATOR TO PREVENT ACCIDENTIAL STARTUP!**

Proper grounding is necessary to help prevent shock if the frame becomes energized during live testing.

**Residual voltage is present at the generator leads, selector switch, circuit breaker, gages and at the regulator panel connections, even with the regulator disconnected or fuse removed. Caution must be observed or serious personal injury or death can result. Consult qualified personnel with any questions.**

**Always wear proper PPE when conducting live voltage tests**

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# TROUBLESHOOTING CHARTS

This manual is intended to suggest a systematic approach to locating and correcting generator malfunctions. The steps have been arranged in an attempt to do the easy checks first and prevent further damage when troubleshooting a disabled machine.

The first step of troubleshooting is to gather as much information as is possible from operating personnel and individuals present during the failure. Typical information includes:

- How long the unit had been operating;
- What voltage was the generator running at when the fault occurred;
- What loads were on line;
- Information about the application the generator was operating is sometimes crucial to determine fault and cause of fault;
- Prior issues with machine;
- Maintenance history;
- Weather conditions;
- Protective equipment that did or did not function;

In addition, information as to the operating condition of the generator's prime mover is vital.

- Has the prime mover been maintaining constant speed? If not, have there been extended periods of under speed operation?
- Has the prime mover experienced an over-speed condition? If yes, what was the maximum speed, and how long did the unit operate at that elevated speed?

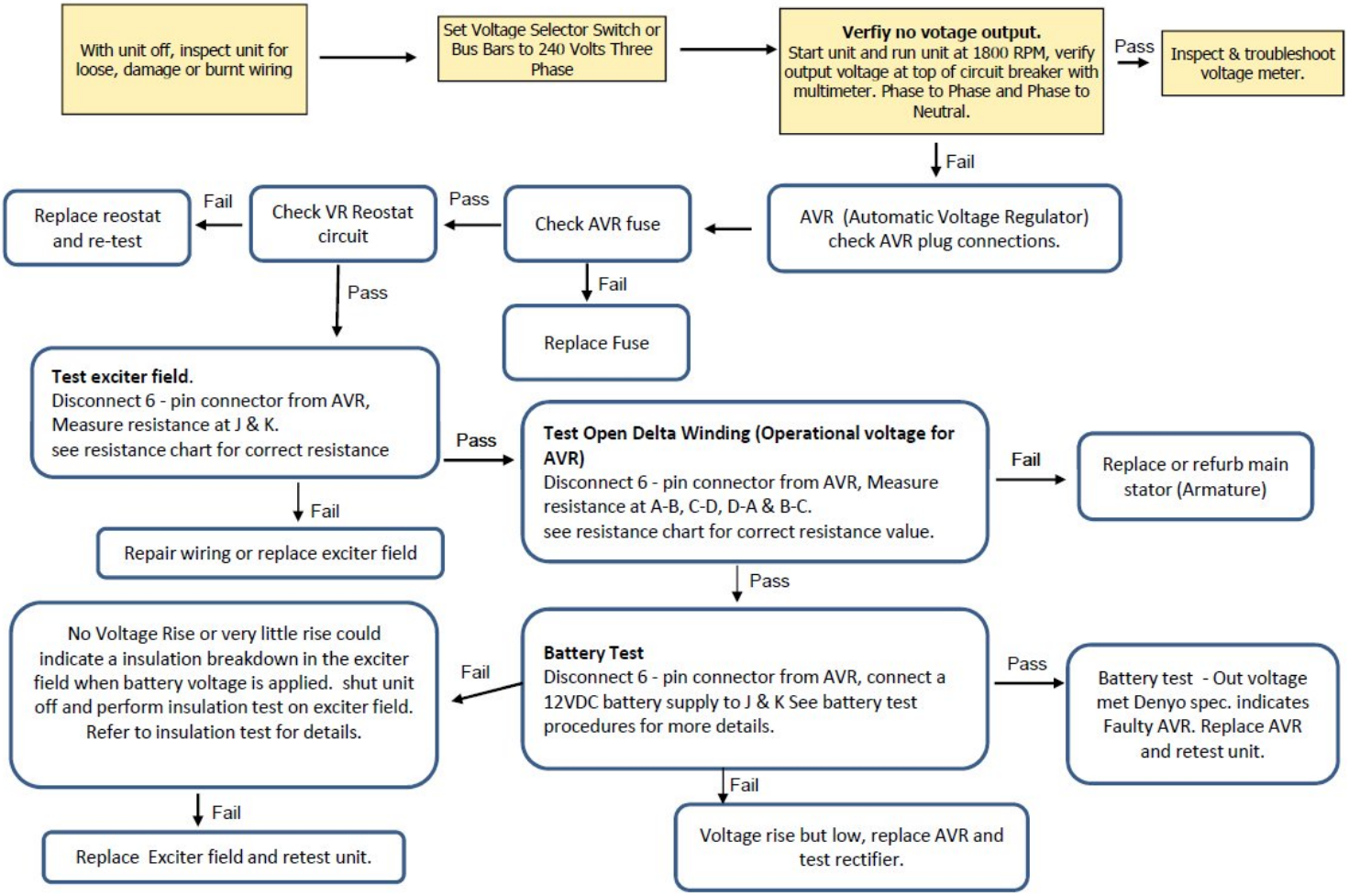
The generator speed should be maintained at rated nameplate value during all operating tests. The frequency of the generator depends upon rotational speed.

Always make a thorough visual inspection to check for obvious problems before attempting to run the generator. Remove covers and look for any obvious problems. Burnt windings, broken connectors, burnt wires, mounting brackets, etc., can usually be identified through inspection. Look for any loose or frayed insulation, loose or dirty connections and broken wires. Check for any foreign objects, loose nuts, bolts and electrical connections.

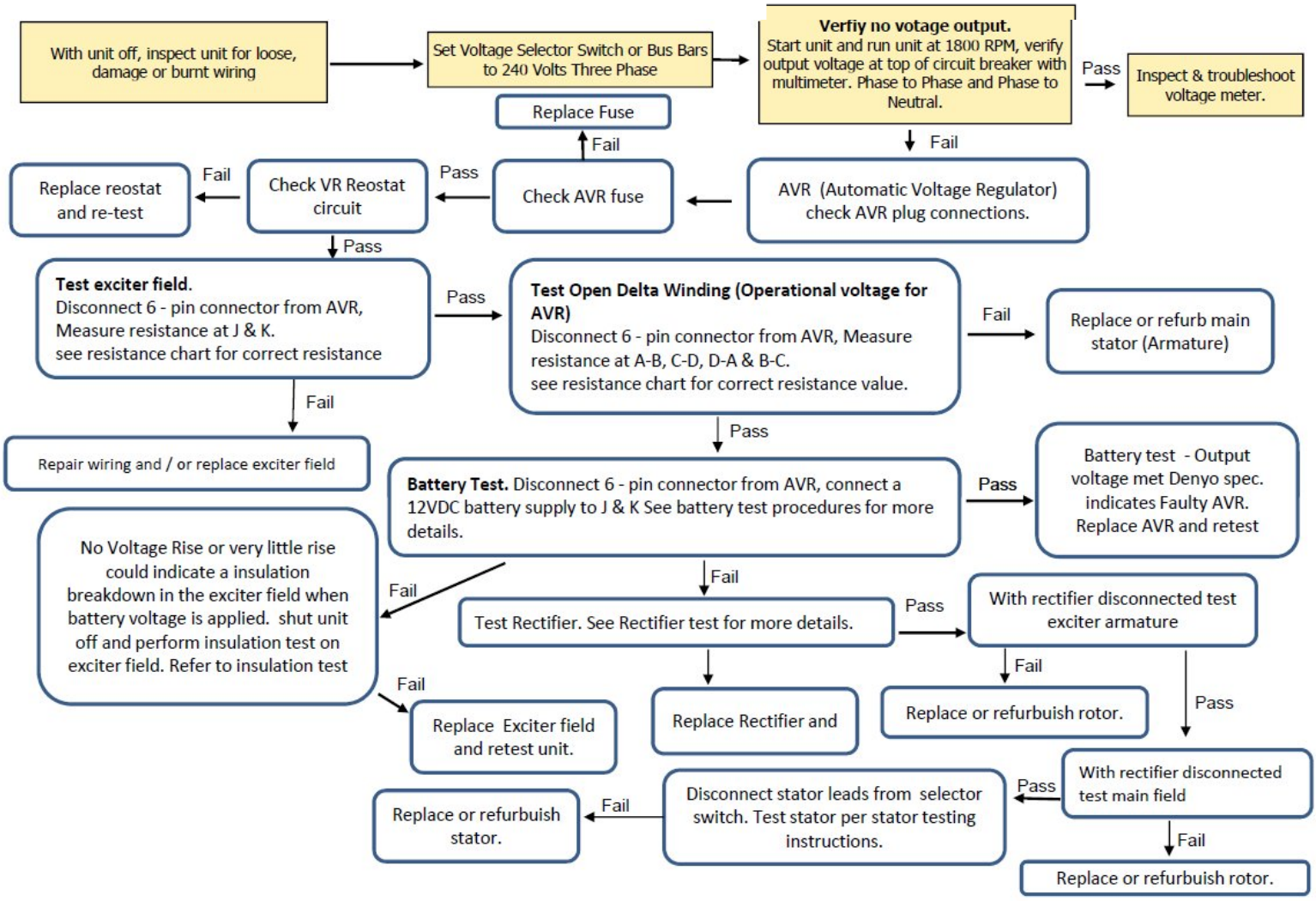
If possible rotate the generator rotor by hand to be sure it turns freely.

If serious problems can be identified before attempting to operate the machine, additional damage can be avoided.

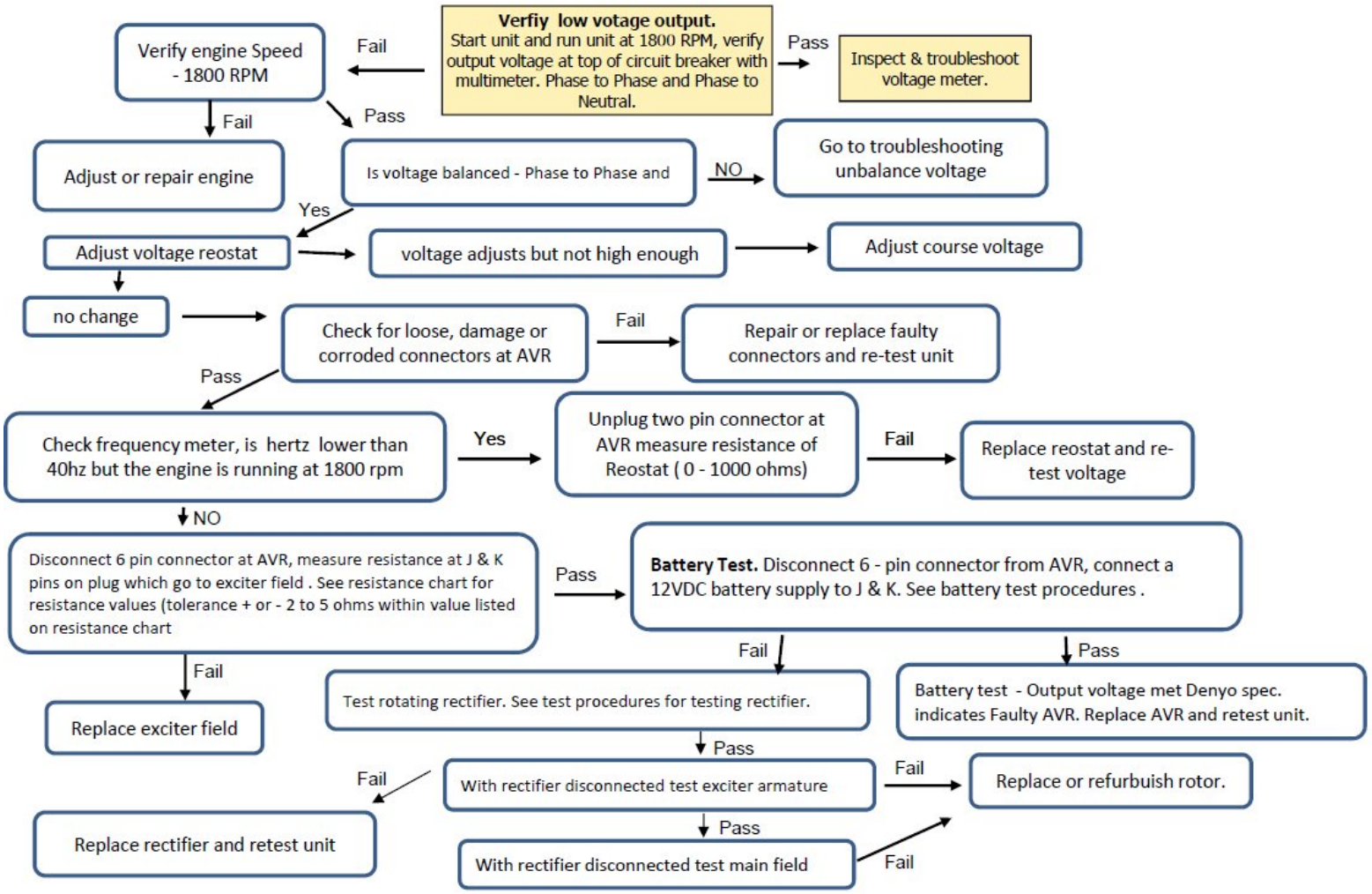
# NO VOLTAGE – RESIDUAL VOLTAGE ONLY


With unit off, inspect unit for loose, damage or burnt wiring
Set Voltage Selector Switch or Bus Bars to 240 Volts Three Phase
Verfiy no votage output. Start unit and run unit at 1800 RPM, verify output voltage at top of circuit breaker with multimeter. Phase to Phase and Phase to Neutral.
Pass
Inspect & troubleshoot voltage meter.
Fail
AVR (Automatic Voltage Regulator) check AVR plug connections.
Check AVR fuse
Pass
Fail
Replace Fuse
Check VR Reostat circuit
Pass
Fail
Replace reostat and re-test
Test exciter field. Disconnect 6 - pin connector from AVR, Measure resistance at J & K. see resistance chart for correct resistance
Pass
Fail
Repair wiring or replace exciter field
Test Open Delta Winding (Operational voltage for AVR) Disconnect 6 - pin connector from AVR, Measure resistance at A-B, C-D, D-A & B-C. see resistance chart for correct resistance value.
Fail
Replace or refurb main stator (Armature)
Pass
Battery Test Disconnect 6 - pin connector from AVR, connect a 12VDC battery supply to J & K See battery test procedures for more details.
Pass
Battery test - Out voltage met Denyo spec. indicates Faulty AVR. Replace AVR and retest unit.
Fail
Voltage rise but low, replace AVR and test rectifier.
Fail
No Voltage Rise or very little rise could indicate a insulation breakdown in the exciter field when battery voltage is applied. shut unit off and perform insulation test on exciter field. Refer to insulation test for details.
Fail
Replace Exciter field and retest unit.

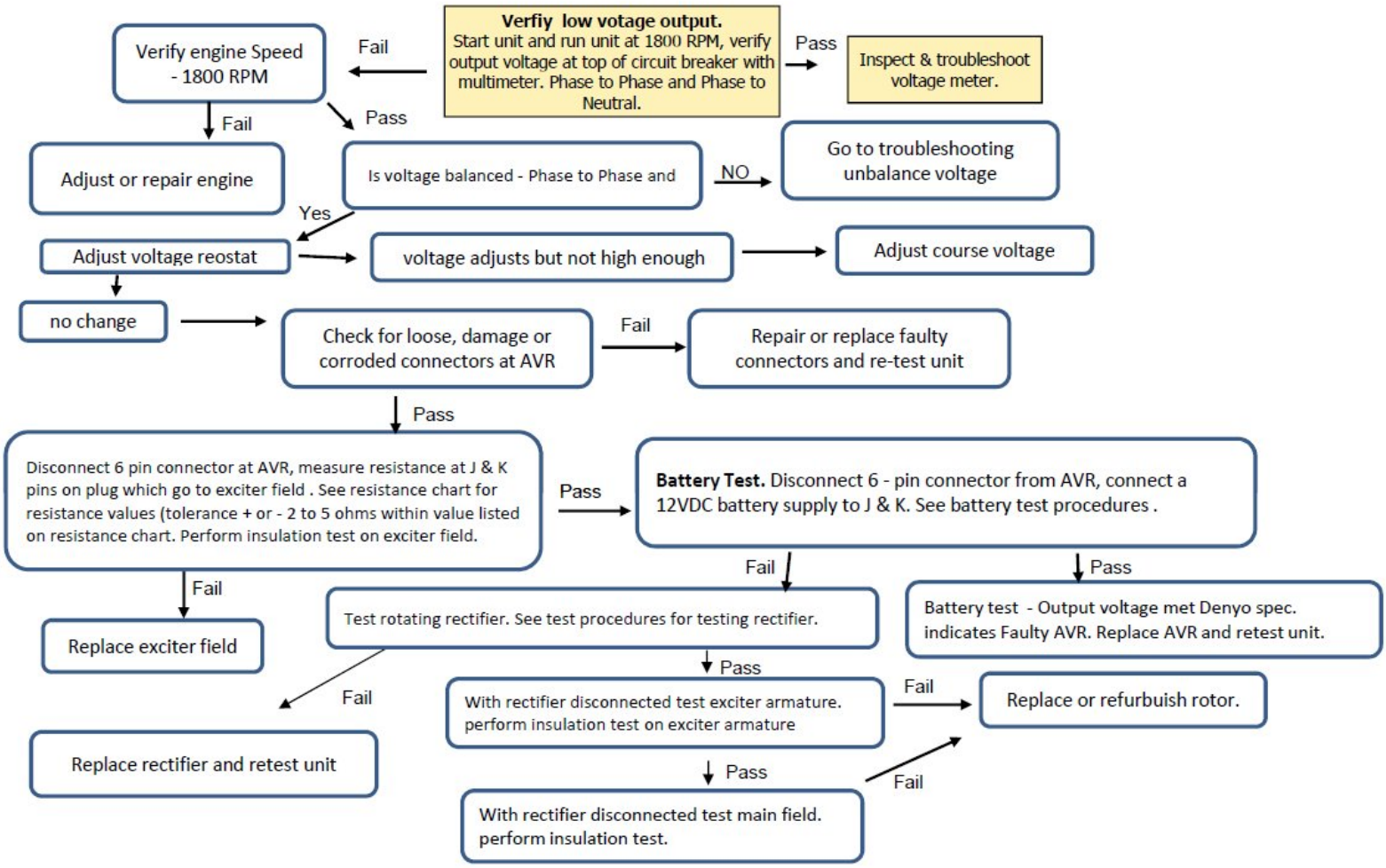
# NO VOLTAGE


With unit off, inspect unit for loose, damage or burnt wiring
Set Voltage Selector Switch or Bus Bars to 240 Volts Three Phase
Verfiy no votage output. Start unit and run unit at 1800 RPM, verify output voltage at top of circuit breaker with multimeter. Phase to Phase and Phase to Neutral.
Pass
Inspect & troubleshoot voltage meter.
Fail
Replace Fuse
Fail
Replace reostat and re-test
Fail
Check VR Reostat circuit
Pass
Check AVR fuse
AVR (Automatic Voltage Regulator) check AVR plug connections.
Pass
Test exciter field. Disconnect 6 - pin connector from AVR, Measure resistance at J & K. see resistance chart for correct resistance
Pass
Test Open Delta Winding (Operational voltage for AVR) Disconnect 6 - pin connector from AVR, Measure resistance at A-B, C-D, D-A & B-C. see resistance chart for correct resistance value.
Fail
Replace or refurb main stator (Armature)
Fail
Repair wiring and / or replace exciter field
Pass
Battery Test. Disconnect 6 - pin connector from AVR, connect a 12VDC battery supply to J & K See battery test procedures for more details.
Pass
Battery test - Output voltage met Denyo spec. indicates Faulty AVR. Replace AVR and retest
No Voltage Rise or very little rise could indicate a insulation breakdown in the exciter field when battery voltage is applied. shut unit off and perform insulation test on exciter field. Refer to insulation test
Fail
Fail
Test Rectifier. See Rectifier test for more details.
Pass
With rectifier disconnected test exciter armature
Fail
Fail
Replace Exciter field and retest unit.
Replace Rectifier and
Replace or refurbuish rotor.
Pass
With rectifier disconnected test main field
Pass
Disconnect stator leads from selector switch. Test stator per stator testing instructions.
Fail
Replace or refurbuish stator.
Fail
Replace or refurbuish rotor.

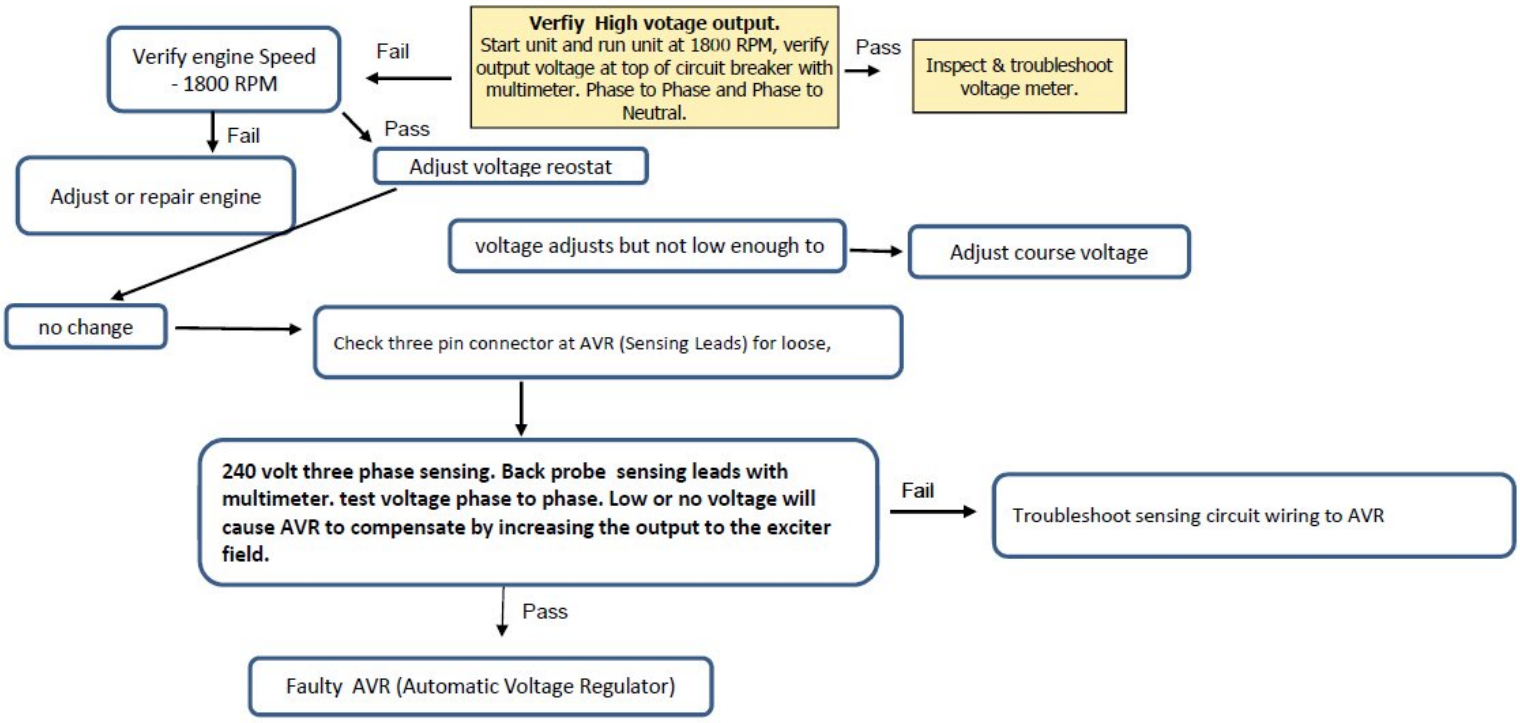
# LOW VOLTAGE – NO LOAD


Verfiy low votage output.
Start unit and run unit at 1800 RPM, verify output voltage at top of circuit breaker with multimeter. Phase to Phase and Phase to Neutral.
Fail
Pass
Inspect & troubleshoot voltage meter.
Verify engine Speed - 1800 RPM
Fail
Pass
Adjust or repair engine
Is voltage balanced - Phase to Phase and
NO
Go to troubleshooting unbalance voltage
Yes
Adjust voltage reostat
voltage adjusts but not high enough
Adjust course voltage
no change
Check for loose, damage or corroded connectors at AVR
Fail
Repair or replace faulty connectors and re-test unit
Pass
Check frequency meter, is hertz lower than 40hz but the engine is running at 1800 rpm
Yes
Unplug two pin connector at AVR measure resistance of Reostat ( 0 - 1000 ohms)
Fail
Replace reostat and re-test voltage
NO
Disconnect 6 pin connector at AVR, measure resistance at J & K pins on plug which go to exciter field . See resistance chart for resistance values (tolerance + or - 2 to 5 ohms within value listed on resistance chart
Pass
Battery Test. Disconnect 6 - pin connector from AVR, connect a 12VDC battery supply to J & K. See battery test procedures .
Fail
Pass
Fail
Replace exciter field
Test rotating rectifier. See test procedures for testing rectifier.
Battery test - Output voltage met Denyo spec. indicates Faulty AVR. Replace AVR and retest unit.
Pass
Fail
With rectifier disconnected test exciter armature
Fail
Replace or refurbuish rotor.
Replace rectifier and retest unit
Pass
With rectifier disconnected test main field
Fail

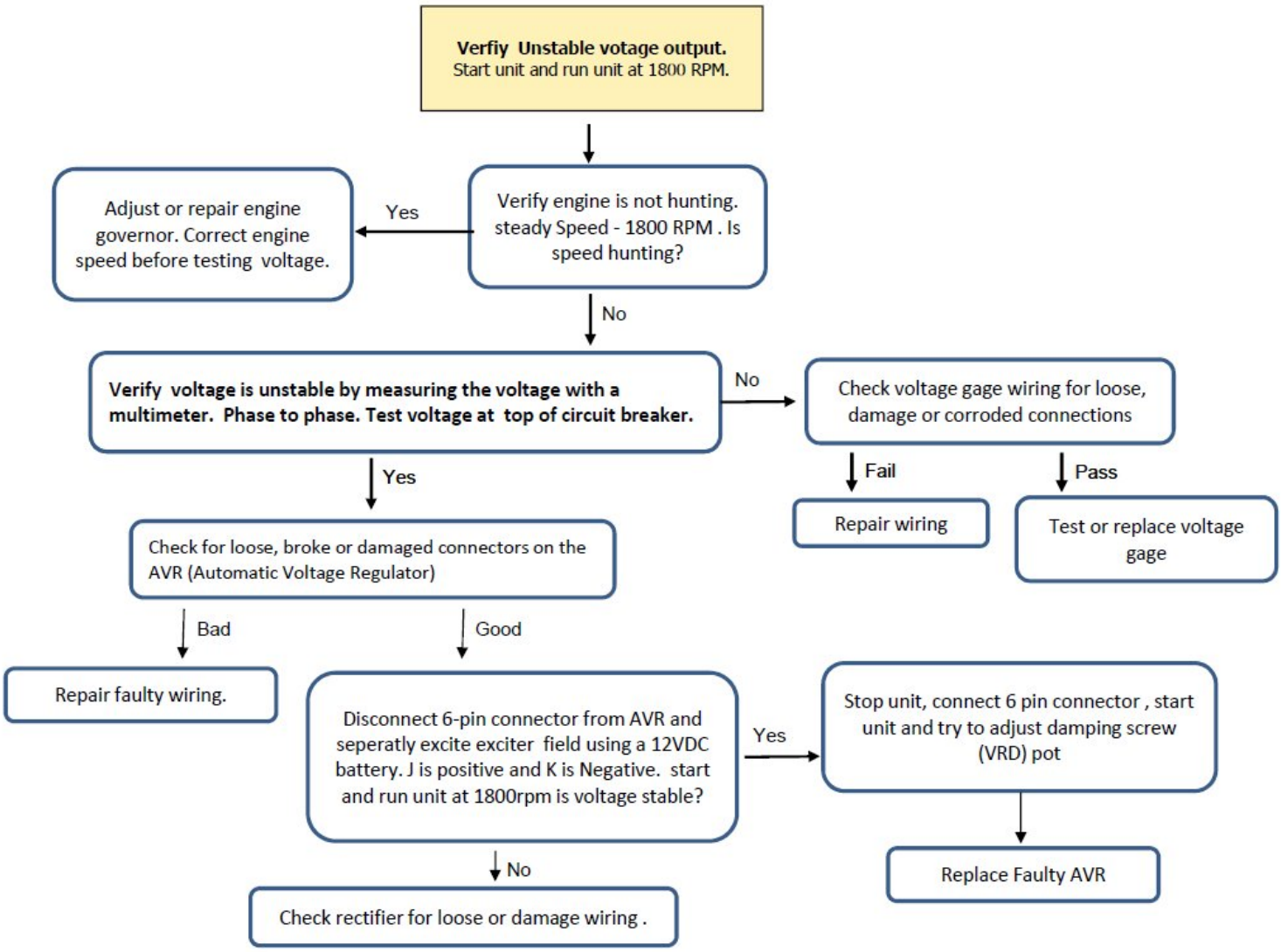
# LOW VOLTAGE – ON LOAD


Verfiy low votage output.
Start unit and run unit at 1800 RPM, verify output voltage at top of circuit breaker with multimeter. Phase to Phase and Phase to Neutral.
Fail
Pass
Inspect & troubleshoot voltage meter.
Verify engine Speed - 1800 RPM
Fail
Pass
Adjust or repair engine
Is voltage balanced - Phase to Phase and
NO
Go to troubleshooting unbalance voltage
Yes
Adjust voltage reostat
voltage adjusts but not high enough
Adjust course voltage
no change
Check for loose, damage or corroded connectors at AVR
Fail
Repair or replace faulty connectors and re-test unit
Pass
Disconnect 6 pin connector at AVR, measure resistance at J & K pins on plug which go to exciter field . See resistance chart for resistance values (tolerance + or - 2 to 5 ohms within value listed on resistance chart. Perform insulation test on exciter field.
Pass
Battery Test. Disconnect 6 - pin connector from AVR, connect a 12VDC battery supply to J & K. See battery test procedures .
Fail
Pass
Fail
Replace exciter field
Test rotating rectifier. See test procedures for testing rectifier.
Battery test - Output voltage met Denyo spec. indicates Faulty AVR. Replace AVR and retest unit.
Pass
Fail
Replace rectifier and retest unit
With rectifier disconnected test exciter armature. perform insulation test on exciter armature
Fail
Replace or refurbuish rotor.
Pass
Fail
With rectifier disconnected test main field. perform insulation test.

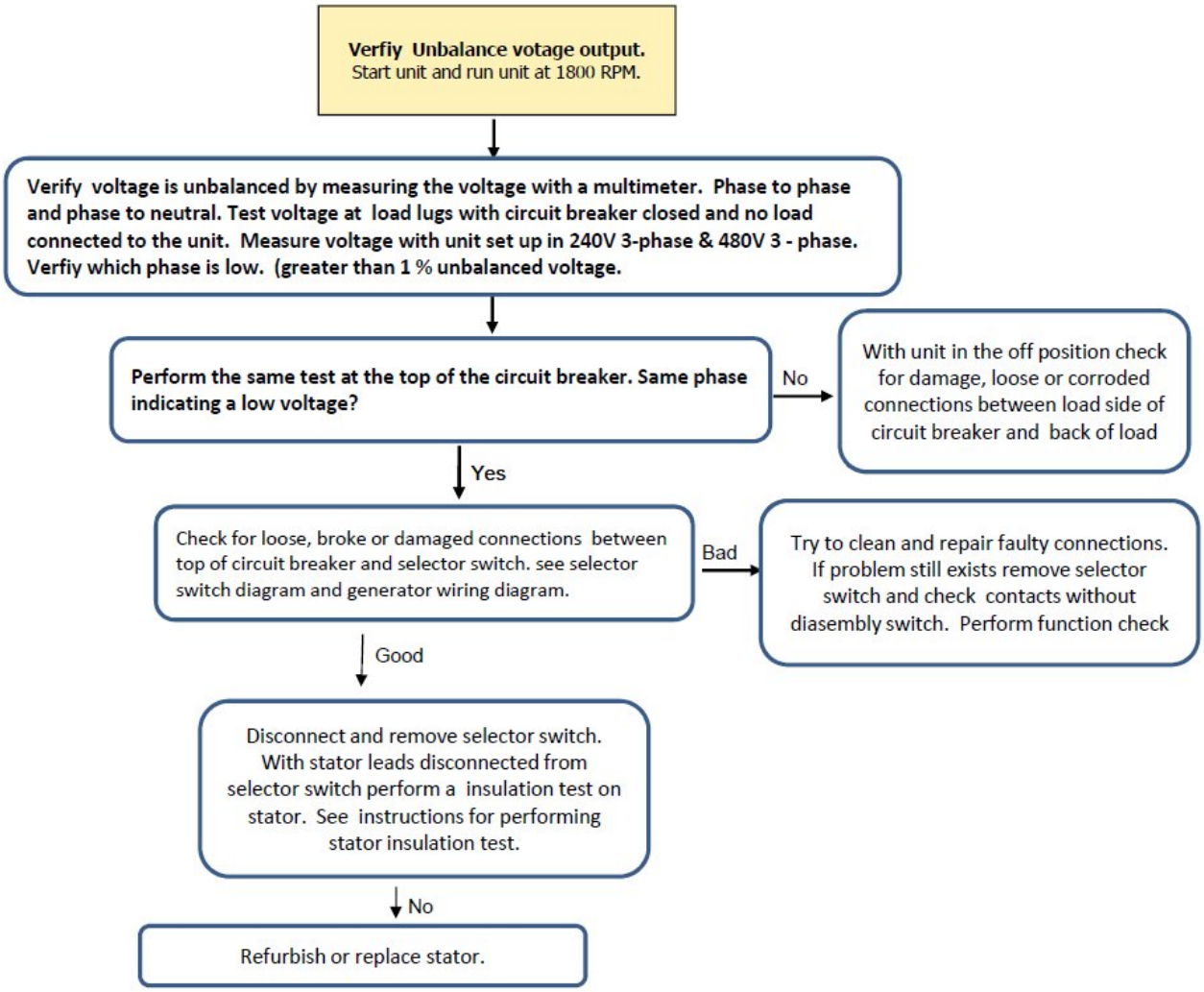
# HIGH VOLTAGE


Verfiy High votage output.
Start unit and run unit at 1800 RPM, verify output voltage at top of circuit breaker with multimeter. Phase to Phase and Phase to Neutral.
Fail
Pass
Inspect & troubleshoot voltage meter.
Verify engine Speed - 1800 RPM
Fail
Pass
Adjust voltage reostat
Adjust or repair engine
voltage adjusts but not low enough to
Adjust course voltage
no change
Check three pin connector at AVR (Sensing Leads) for loose,
240 volt three phase sensing. Back probe sensing leads with multimeter. test voltage phase to phase. Low or no voltage will cause AVR to compensate by increasing the output to the exciter field.
Fail
Troubleshoot sensing circuit wiring to AVR
Pass
Faulty AVR (Automatic Voltage Regulator)

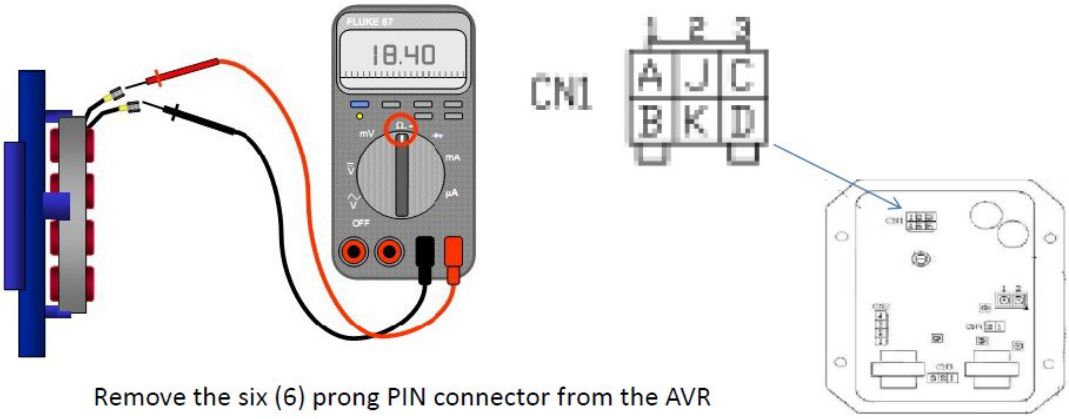
# VOLTAGE UNSTABLE – NO LOAD


Verfiy Unstable votage output.
Start unit and run unit at 1800 RPM.
Verify engine is not hunting. steady Speed - 1800 RPM . Is speed hunting?
Yes
Adjust or repair engine governor. Correct engine speed before testing voltage.
No
Verify voltage is unstable by measuring the voltage with a multimeter. Phase to phase. Test voltage at top of circuit breaker.
No
Check voltage gage wiring for loose, damage or corroded connections
Fail
Repair wiring
Pass
Test or replace voltage gage
Yes
Check for loose, broke or damaged connectors on the AVR (Automatic Voltage Regulator)
Bad
Repair faulty wiring.
Good
Disconnect 6-pin connector from AVR and seperatly excite exciter field using a 12VDC battery. J is positive and K is Negative. start and run unit at 1800rpm is voltage stable?
Yes
Stop unit, connect 6 pin connector , start unit and try to adjust damping screw (VRD) pot
Replace Faulty AVR
No
Check rectifier for loose or damage wiring .

# VOLTAGE UNBALANCE


Verfiy Unbalance votage output.
Start unit and run unit at 1800 RPM.
Verify voltage is unbalanced by measuring the voltage with a multimeter. Phase to phase and phase to neutral. Test voltage at load lugs with circuit breaker closed and no load connected to the unit. Measure voltage with unit set up in 240V 3-phase & 480V 3 - phase. Verfiy which phase is low. (greater than 1 % unbalanced voltage.
Perform the same test at the top of the circuit breaker. Same phase indicating a low voltage?
No
With unit in the off position check for damage, loose or corroded connections between load side of circuit breaker and back of load
Yes
Check for loose, broke or damaged connections between top of circuit breaker and selector switch. see selector switch diagram and generator wiring diagram.
Bad
Try to clean and repair faulty connections. If problem still exists remove selector switch and check contacts without diasembly switch. Perform function check
Good
Disconnect and remove selector switch. With stator leads disconnected from selector switch perform a insulation test on stator. See instructions for performing stator insulation test.
No
Refurbish or replace stator.

# TESTING EXCITER FIELD RESISTANCE



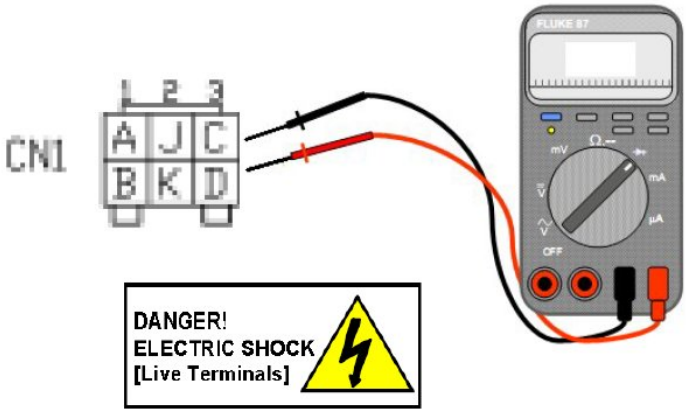

1. Remove the six (6) prong PIN connector from the AVR

2. Set Multimeter to Ohms Resistance.

3. Insert Multimeter leads into the two center PINS of the AVR connector **(harness side)**. PINS will be marked with the tags "J and K".

4. Read the resistance value of the exciter field and determine if the resistance is within specifications (usually within 2-5 Ohms of nominal) or if the field is entirely open. To find the resistance value for your particular model of unit reference the "Data Sheet" located in the "Generator Specifications and Data" section of this manual.

# TESTING VOLTAGE INPUT TO AVR OPEN DELTA WINDINGS




The no load voltage should be: (Back probe CN1 connector. See Chart for specifications per model)

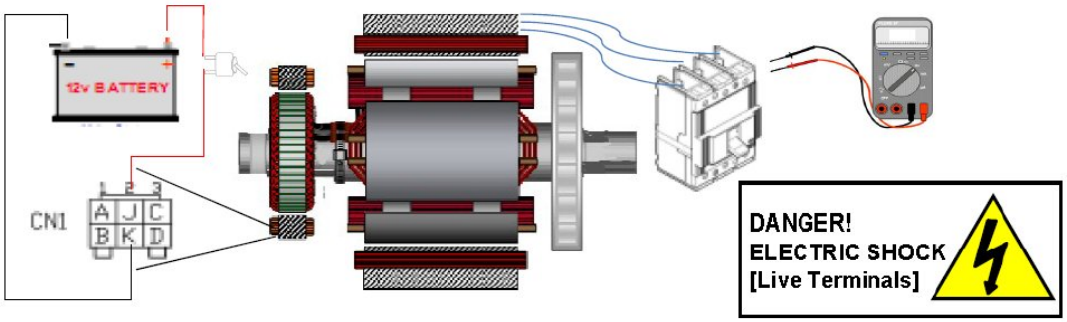
Voltage Test

A-B ___-___ VAC
A-D ___-___ VAC
C-D ___-___ VAC
B-C _____ VAC

Open Delta Windings Resistance test

A-B _____Ω
A-D _____ Ω
C-D _____ Ω
B-C _____ Ω

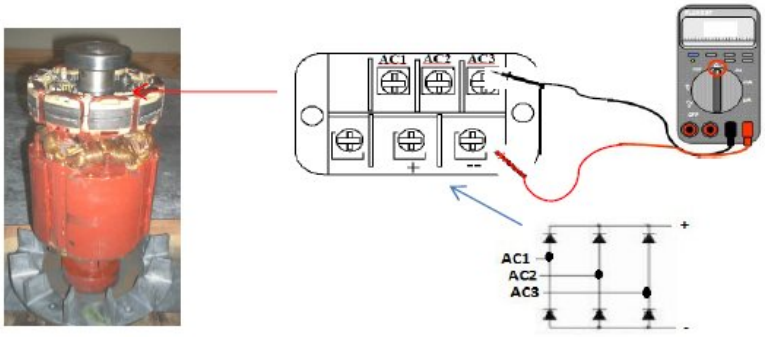
# MANUAL EXCITATION TEST
# USING A BATTERY & VOLTAGE BALANCE TEST




1.) With engine off turn the selector switch to the 240 volt / 3 phase position
2.) Unplug the 6 pin connector from the AVR. Find the wires J & K
3.) Connect a single pole toggle switch between bat pos + & J on the CN1 plug.
4.) Connect a wire between Bat neg – and the K terminal on the CN1 plug.
5.) With toggle switch in open position start engine, in the idle position close toggle switch.
6.) Put unit in the full run position(1800 rpm) and measure voltage at the top (line side) of the main circuit breaker. Take both phase to phase & phase to neutral measurements. Compare the reading to the Denyo chart.
7.) Check to see if voltage is balanced within 1% phase to phase & phase to neutral.

# ROTATING RECTIFIER TEST

ALWAYS DISABLE ENGINE BEFORE WORKING INSIDE A GENERATOR !

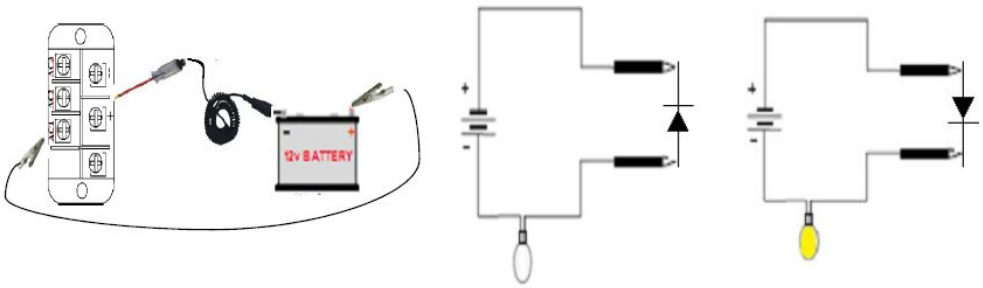



The Rotating Rectifier is a Full Wave Diode Bridge Rectifier and utilizes four (6) diodes to convert one full wave of alternating current into one full pulse of direct current.

An open or failed Rotating Rectifier can cause a no voltage fault as has been described. Some of the units have two (2) rectifiers due to the output magnitude of the unit. The testing for these components would be the same across the entire product line and requires a Multimeter :

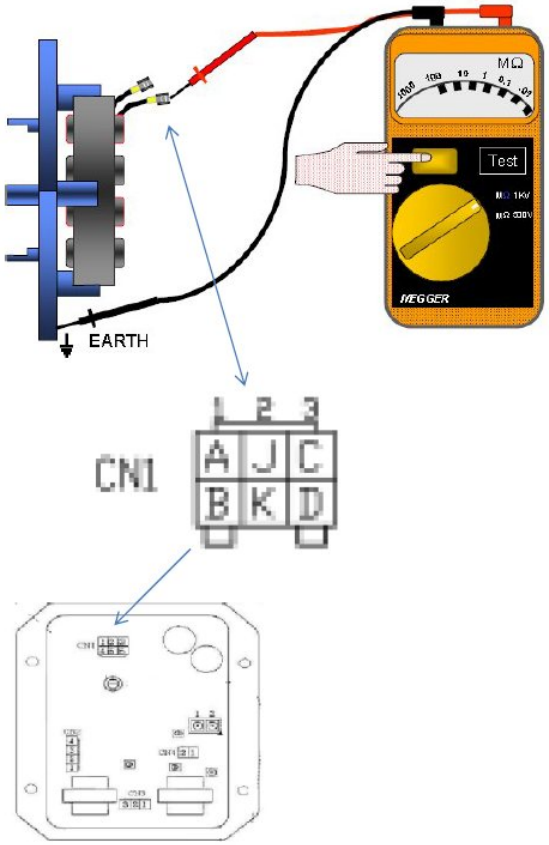
1. Locate the rectifier(s) on the rotor plate.
2. Remove wiring to the rotating rectifier.
3. Set the Multimeter to _____ and touch and hold the positive (+) lead of the Multimeter to the positive (+) of the rectifier. Touch the negative (-) lead of the Multimeter to the AC1, AC2, and AC3 terminals one at a time. This should indicate a reading of approximately _____.
4. Reverse the Multimeter lead connections (as opposed to Step 3), this should indicate an open circuit (OL).
5. Touch and hold the negative (-) lead of the Multimeter to the negative (-) of the rectifier. Touch the positive (+) lead of the Multimeter to the AC1, AC2, and AC3 terminals one at a time. This should indicate a reading of approximately _____
6. Reverse the Multimeter lead connections (as opposed to Step 5), this should indicate an open circuit

# TESTING ROTATING RECTIFIER USING A 12V *DC* TEST LIGHT




A good rectifier will light the test light in only one direction. It should not light the test Light when the leads are reversed.. A faulty diode inside the full wave recifier if it lights The test light in both the directions (short circuit diode) or no light in either direction (open circuit diode).

# EXCITER FIELD INSULATION TEST




Disconnect the 6 – pin connector from the AVR.

Find J & K in the 6 – pin connector going to the generator.

Connect the pos lead of the megger to J in the plug and the neg lead to ground.

Set the megger to 250V

The reading should be 1.0 megaohms to ground (earth) or higher.

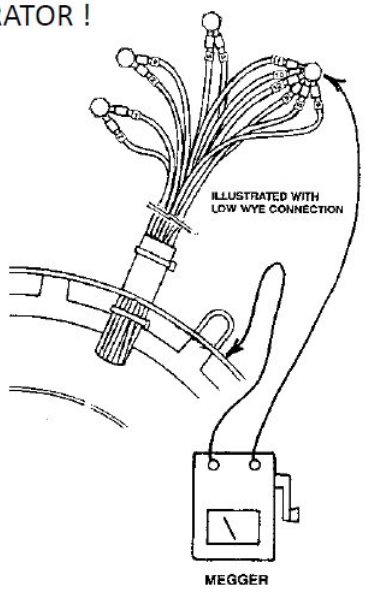
A lower reading the windings may be wet, allow unit to dry and re-run test. Lower reading the winding should be refurbished by a rewind facility.

# STATOR INSULATION TEST

ALWAYS DISABLE ENGINE BEFORE WORKING INSIDE A GENERATOR !

Stator Insulation Test

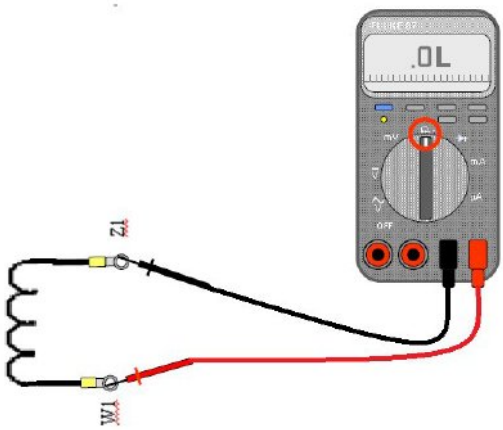
Isolate all twelve leads, connect the leads in a low wye connection
Make sure no other electronic devices are attached and the leads are isolated from ground. Using a 500volt megger touch positive lead to the stator and the negative lead to ground take the megger reading. Min acceptable reading is 2 megaohms. If the reading is below recommended values the windings must be dried out or repaired.

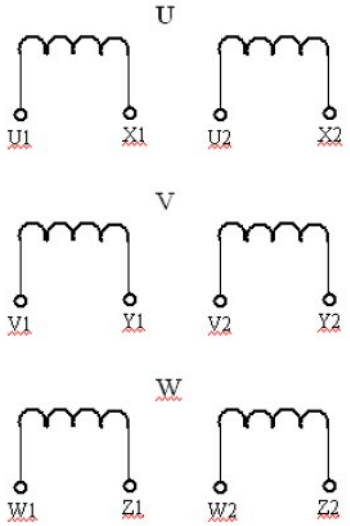


# TEST STATOR WINDINGS

**Stator Test**

Disconnect all stator leads, with a VOM measure the following leads,
The resistance reading should be low most VOM will read continuity.
Check for an open winding:

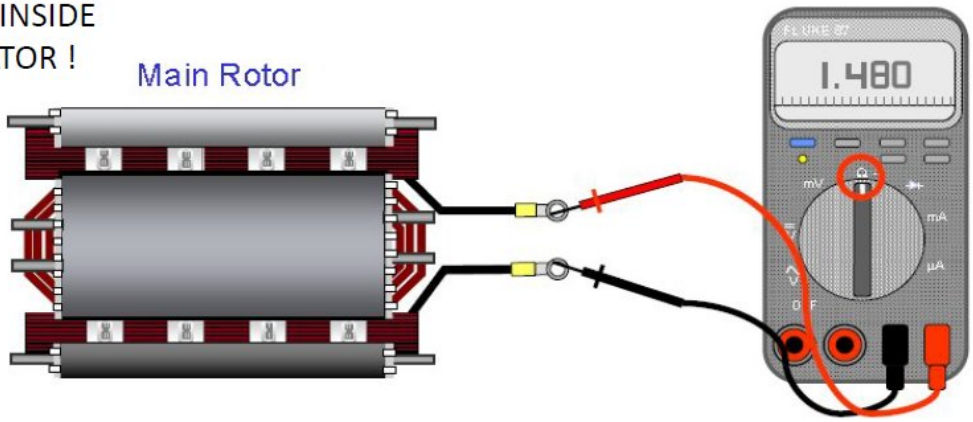


ALWAYS DISABLE ENGINE BEFORE WORKING INSIDE A GENERATOR !

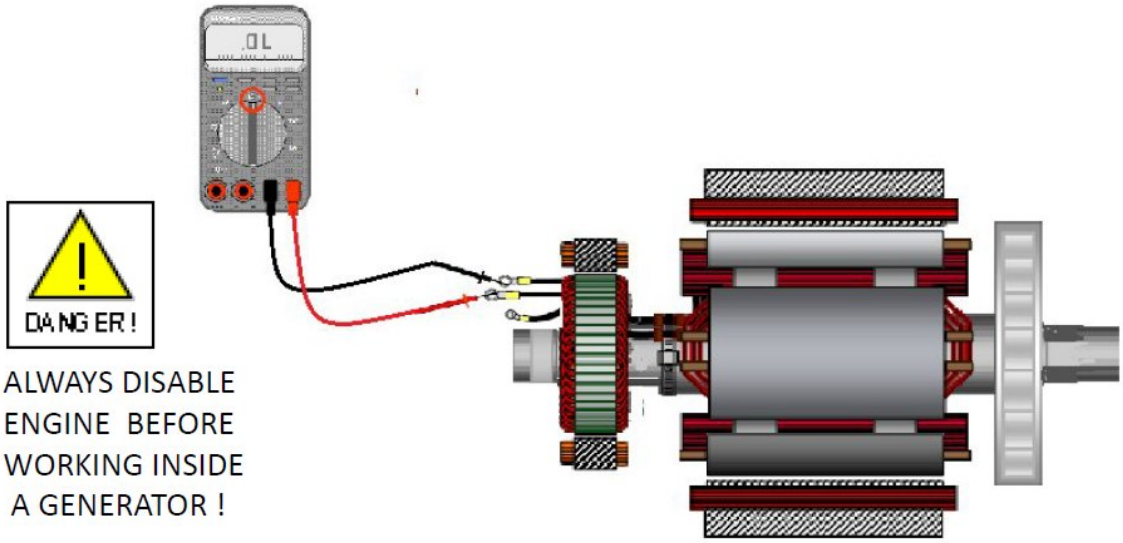
# TEST MAIN ROTOR FIELD

ENGINE BEFORE WORKING INSIDE A GENERATOR !




**The Main Rotor resistance is checked with a multi-meter set on the Ω range. Disconnect the main rotor leads from the rotating rectifier mark (+) and (-). Measure windings for a short or open. Record resistance reading and compare value to resistance chart.**

# TEST EXCITER ARMATURE




ALWAYS DISABLE ENGINE BEFORE WORKING INSIDE A GENERATOR !

**The exciter armature resistance is checked with a multi-meter set on the Ω range. Disconnect the exciter armature leads(AC1, AC2 & AC3) from the rotating rectifier . Measure windings for a short or open. Record resistance reading and compare value to resistance chart.**

# TABLE OF GENERATOR DATA

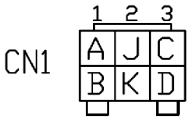
| Generator Models | | Winding Resistance (Ω) | | | | | | Exciter(Ex)Field Current(A) | | | | Exciter(Ex)Field Voltage(V) | | | | Induction Voltage(V) by separate Excitation(12V) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Single Unit of Generator | General | Main | | Exiting Windings | | Exciter Windings (Ex) | | No Load | | Rated Load | | No Load | | Rated Load | | Three-Phase Voltage U-V/V-W/W-U | | Exciting Winding Voltage A-B/C-D/D-A | |
| | | Ar | Fg | A-B/C-D /D-A | B-C | Ar | Fg | 50Hz | 60Hz | 50Hz | 60Hz | 50Hz | 60Hz | 50Hz | 60Hz | 50Hz | 60Hz | 50Hz | 60Hz |
| DFS-0140X | DCA-10SPX | 0.160 | 2.84 | 1.12 | 3.35 | 0.30 | 17.6 | 0.77 | 0.57 | 1.37 | 1.29 | 13.5 | 11.0 | 26.0 | 24.5 | – | – | – | – |
| DFS-0220X | DCA-15SPX | 0.062 | 3.66 | 0.90 | 2.60 | 0.30 | 17.6 | 0.94 | 0.74 | 1.45 | 1.27 | 16.5 | 13.0 | 27.5 | 24.0 | – | – | – | – |
| DF-0277 | DCA-20SPX | 0.053 | 4.00 | 0.76 | 2.28 | 0.30 | 17.6 | 0.93 | 0.73 | 1.55 | 1.37 | 16.4 | 12.8 | 31.5 | 27.9 | 164 | 203 | 55 | 69 |
| DB-1007 | DCA-56SPX | 0.008 | 1.33 | 0.31 | 0.92 | 0.08 | 17.3 | 0.91 | 0.73 | 1.60 | 1.36 | 15.7 | 12.6 | 32.0 | 27.2 | – | – | – | – |
| | | | | | | | | | | | | | | | | | | | |
| DF-0270 | DCA-25SS/US | 0.124 | 4.00 | 0.90 | 2.60 | 0.30 | 17.6 | 0.84 | 0.67 | 2.18 | 1.92 | 16.1 | 12.3 | 46.6 | 37.1 | 165 | 212 | 56 | 72 |
| DB-1001 | DCA-85SS/US | 0.021 | 1.33 | 0.32 | 0.96 | 0.08 | 17.3 | 0.97 | 0.76 | 2.59 | 2.23 | 16.8 | 13.1 | 51.8 | 44.6 | 163 | 195 | 58 | 70 |
| DB-1381 | DCA-125SS/US | 0.015 | 1.52 | 0.28 | 0.84 | 0.08 | 17.3 | 1.27 | 0.96 | 2.92 | 2.59 | 22.0 | 16.6 | 58.4 | 51.8 | 138 | 165 | 49 | 59 |
| DB-1651 | DCA-150SS/US | 0.011 | 1.75 | 0.27 | 0.81 | 0.08 | 17.3 | 1.23 | 0.96 | 2.87 | 2.54 | 21.3 | 16.6 | 57.4 | 50.8 | 141 | 169 | 53 | 63 |
| DF-1950 | DCA-180SS | 0.011 | 1.54 | 0.32 | 0.96 | 0.11 | 17.2 | 0.97 | 0.80 | 2.76 | 2.65 | 16.7 | 13.8 | 54.9 | 52.7 | 160 | 200 | 63 | 79 |
| DF-2400 | DCA-220/250SS | 0.007 | 1.80 | 0.30 | 0.90 | 0.11 | 17.2 | 1.05 | 0.88 | 2.92 | 2.59 | 18.1 | 15.1 | 57.9 | 51.3 | 150 | 188 | 62 | 75 |
| DF-3300 | DCA-300SS | 0.005 | 2.49 | 0.27 | 0.81 | 0.12 | 19.3 | 0.93 | 0.72 | 2.75 | 2.40 | 17.9 | 13.9 | 54.7 | 47.8 | 160 | 196 | 67 | 82 |
| DF-4400 | DCA-400SS | 0.003 | 2.83 | 0.30 | 0.90 | 0.12 | 19.3 | 0.93 | 0.78 | 2.88 | 2.75 | 17.9 | 15.1 | 57.3 | 54.7 | 160 | 198 | 77 | 94 |
| DF-6600 | DCA-600SS | 0.002 | 2.02 | 0.24 | 0.72 | 0.09 | 26.6 | 0.70 | 0.52 | 2.25 | 1.83 | 18.6 | 13.8 | 69.2 | 56.3 | 160 | 203 | 73 | 91 |

*The above values are for reference only.

# AUTOMATIC VOLTAGE REGULATOR

There are four connectors that attach to the AVR and two wires to the AVR terminals. The AVR also has three potentiometers, only one is for course adjustment the other two should NOT be touched.

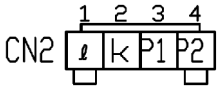
**IMORTANT**: There is no procedure for directly testing the AVR, use process of elimination.




Open delta leads and excitation leads connect to the AVR on this connector.

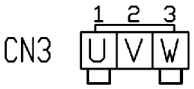
**DCA 25 ONLY**
A ~ Wire is – YELLOW
B ~ Wire is – ORANGE
C ~ Wire is – WHITE
D ~ Wire is – GRAY
J ~ Wire is – RED
K ~ Wire is – BLUE

**DCA 45 to DCA 150**
A ~ Wire is labeled ~ A
B ~ Wire is labeled ~ B
C ~ Wire is labeled ~ C
D ~ Wire is labeled ~ D
J ~ Wire is labeled ~ J
K ~ Wire is labeled ~ K
(wires colors are black)



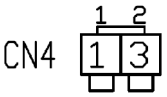

This connector has no outside connection and has a couple of bridge jumper wires.

P1, P2 ~ Wire is WHITE and are bridged together.
ℓ, K ~ Wire is WHITE and are bridged together.



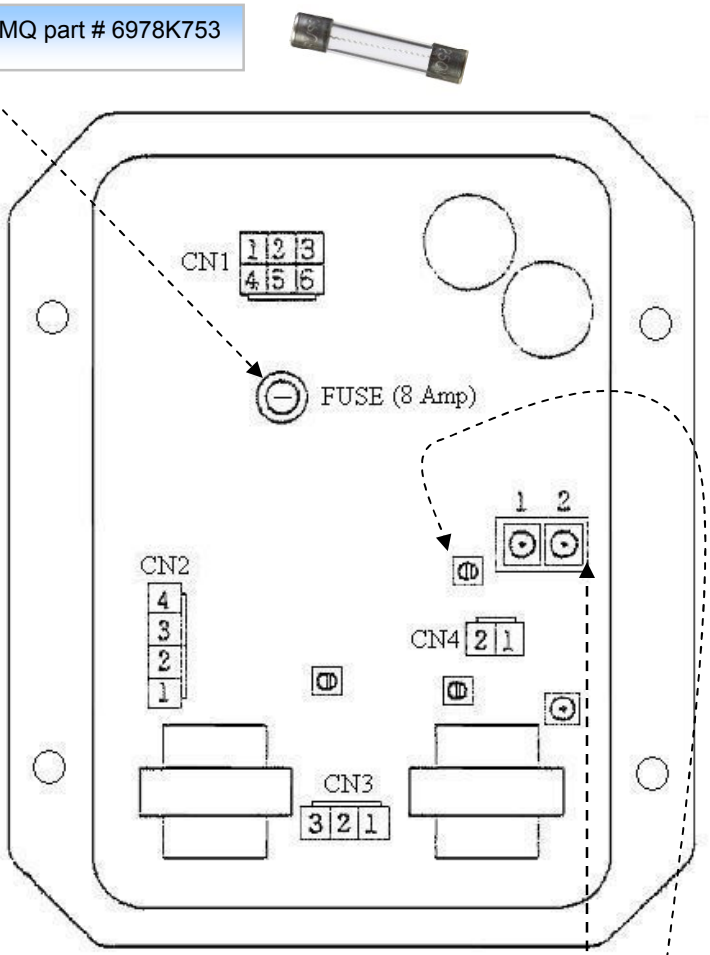

Wires connected here are for AVR internal sensing.

U ~ Wire is RED and is connected to terminal # 14 on the voltage selector switch.
V ~ Wire is WHITE and is connected to V-Leg Relay (RY1)
W ~ Wire is BLUE and is connected to terminal # 36 on the voltage selector switch.



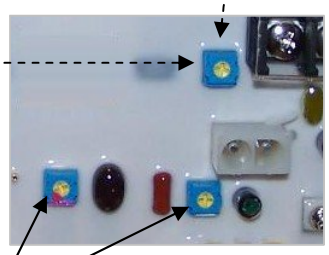

This connects the Rheostat (VR) to the AVR.

1 ~ Wire is GRAY
3 ~ Wire is YELLOW




This potentiometer (pot) is the voltage course adjustment pot.

**VISUAL REMINDER**: The pots are positioned similar to a backwards capital letter 'L'



**DO NOT!** adjust the other two pots, these are factory pre-set.

# GEN-SET DATA

The chart below can be used as a reference guide for measuring resistance on the Gen-Set

| CROSS REFERENCE CHART | | RESISTANCE MEASURED IN OHMS Ω | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Main Armature | |
| | | | | | | | AVR Inputs | |
| Generator Model # | Gen-Set Model # | Main | | Exciter | | | A-B | B-C |
| | | Armature | Field | Armature | Field | Field 2 | C-D | |
| | | AC Outputs | DC+ DC- | U V W | J + K - | | D-A | |
| **DCA-25SSAI** | **-** | 0.14 | 2 | 0.47 | 51 | 51 | 0.9 | 2.7 |
| **DCA-25SSI** | **DB-0281** | 0.155 | 1.09 | 0.16 | 14 | - | 0.83 | 2.5 |
| **DCA-25SSI2** | **DF-0270** | 0.124 | 4 | 0.3 | 17.6 | - | 0.9 | 2.7 |
| **DCA-25SSIU / SSIU2** | **DF-0270** | 0.124 | 4 | 0.3 | 17.6 | - | 0.9 | 2.7 |
| **DCA-25USI / USI2** | **DF-0270** | 0.124 | 4 | 0.3 | 17.6 | - | 0.9 | 2.7 |
| **DCA-40SSAI** | **-** | 0.1074 | 0.143 | 0.143 | 13 | 13 | 0.5 | 1.5 |
| **DCA-40SSI** | **DB-0501** | 0.082 | 1.46 | 0.21 | 15 | - | 0.74 | 2.22 |
| **DCA-45SSIU** | **DB-0501** | 0.082 | 1.46 | 0.21 | 15 | - | 0.74 | 2.22 |
| **DCA-45SSIU2 / SSJU3** | **DB-0501** | 0.082 | 1.46 | 0.21 | 15 | - | 0.74 | 2.22 |
| **DCA-45SSIU4** | **DH-0480** | 0.099 | 1.33 | 0.137 | 18.8 | | 0.78 | 2.15 |
| **DCA-45USI** | **DB-0501** | 0.082 | 1.46 | 0.21 | 15 | - | 0.74 | 2.22 |
| **DCA-45USI2** | **DH-0480** | 0.099 | 1.33 | 0.137 | 18.8 | | 0.78 | 2.15 |
| **DCA-60SSAI** | **-** | 0.042 | 0.93 | 0.143 | 12 | 12 | 0.41 | 1.25 |
| **DCA-60SSI / SSI2** | **DB-0661** | 0.048 | 1.8 | 0.21 | 15 | - | 0.61 | 1.83 |
| **DCA-70SSJU / SSJU2** | **DB-0831** | 0.032 | 1.2 | 0.08 | 17.3 | - | 0.37 | 1.11 |
| **DCA-70SSI / SSIU** | **DB-0831** | 0.032 | 1.2 | 0.08 | 17.3 | - | 0.37 | 1.11 |
| **DCA-70SSIU2** | **DH-0750** | 0.046 | 1.79 | 0.137 | 18.8 | - | 0.67 | 1.85 |
| **DCA-70USJ / USI** | **DB-0831** | 0.032 | 1.2 | 0.08 | 17.3 | - | 0.37 | 1.11 |
| **DCA-70USI2** | **DH-0750** | 0.046 | 1.79 | 0.137 | 18.8 | - | 0.67 | 1.85 |
| **DCA-85SSJU / SSJU2** | **DB-1001** | 0.021 | 1.33 | 0.08 | 17.3 | - | 0.32 | 0.96 |
| **DCA-85USJ /USJ2** | **DB-1001** | 0.021 | 1.33 | 0.08 | 17.3 | - | 0.32 | 0.96 |
| **DCA-85SSK / SSM** | **DB-1001** | 0.021 | 1.33 | 0.08 | 17.3 | - | 0.32 | 0.96 |
| **DCA-100SSJU** | **DB-1101** | 0.022 | 1.4 | 0.08 | 17.3 | - | 0.32 | 0.97 |
| **DCA-125SSK** | **DB-1381** | 0.015 | 1.52 | 0.08 | 17.3 | - | 0.28 | 0.84 |
| **DCA-125SSM / SSM2** | **DB-1381** | 0.015 | 1.52 | 0.08 | 17.3 | - | 0.28 | 0.84 |
| **DCA-125SSJU** | **DB-1381** | 0.015 | 1.52 | 0.08 | 17.3 | - | 0.28 | 0.84 |
| **DCA-125USJ / USI** | **DB-1381** | 0.015 | 1.52 | 0.08 | 17.3 | - | 0.28 | 0.84 |
| **DCA-150SSK / SSK2** | **DB-1651** | 0.011 | 1.75 | 0.08 | 17.3 | - | 0.27 | 0.82 |
| **DCA-150SSM** | **DB-1651** | 0.011 | 1.75 | 0.08 | 17.3 | - | 0.27 | 0.82 |
| **DCA-150SSJU / SSV** | **DB-1651** | 0.011 | 1.75 | 0.08 | 17.3 | - | 0.27 | 0.82 |
| **DCA-150SSJU2** | **DB-1651** | 0.011 | 1.75 | 0.08 | 17.3 | - | 0.27 | 0.82 |
| **DCA-150USJ / USJ2** | **DB-1651** | 0.011 | 1.75 | 0.08 | 17.3 | - | 0.27 | 0.82 |

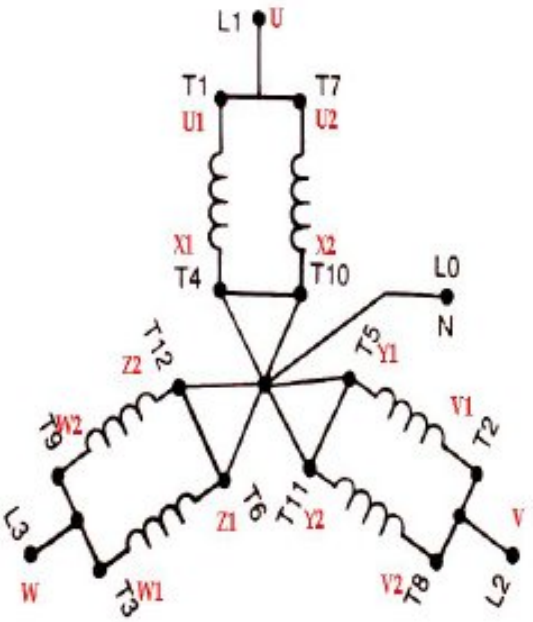
| **Name of Part** | **Wires** | **Location of Wires** |
|---|---|---|
| Exciter Field | J & K | (connected to AVR) |
| Exciter Armature | U V W | (connected to rotating rectifier) |
| Main Field | DC+ DC – | (connected to rotating rectifier) |
| Main Armature | 12 Load Leads | (AC Outputs) |
| | 4 Open Delta Leads | (connected to AVR – A,B,C,D) |

**Measuring between *AC* Output leads**

**U1** to **X1**
**U2** to **X2**
**V1** to **Y1**
**V2** to **Y2**
**W1** to **Z1**
**W2** to **Z2**

# WYE DIAGRAMS

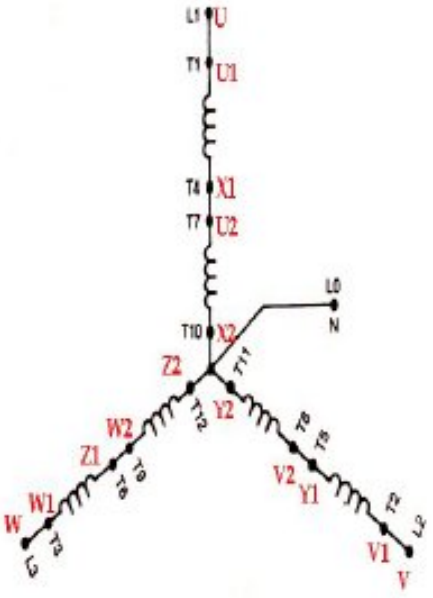
## 3 Phase Low Wye




Parallel connection produces lower voltage and higher amperage.

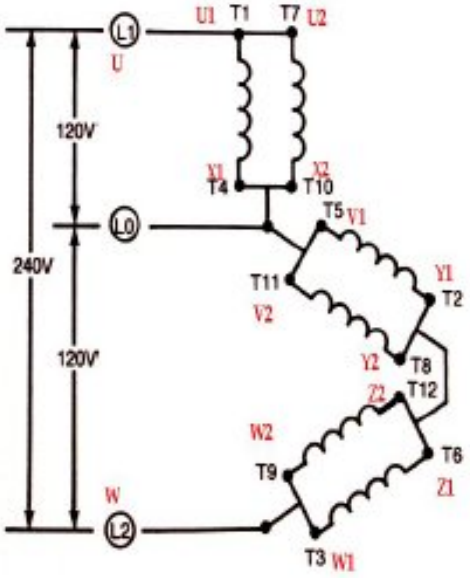
240VAC Phase to Phase
139VAC Phase to Neutral

## 3 Phase High Wye




Series connection produces higher voltage and lower amperage.

480VAC Phase to Phase
277VAC Phase to Neutral

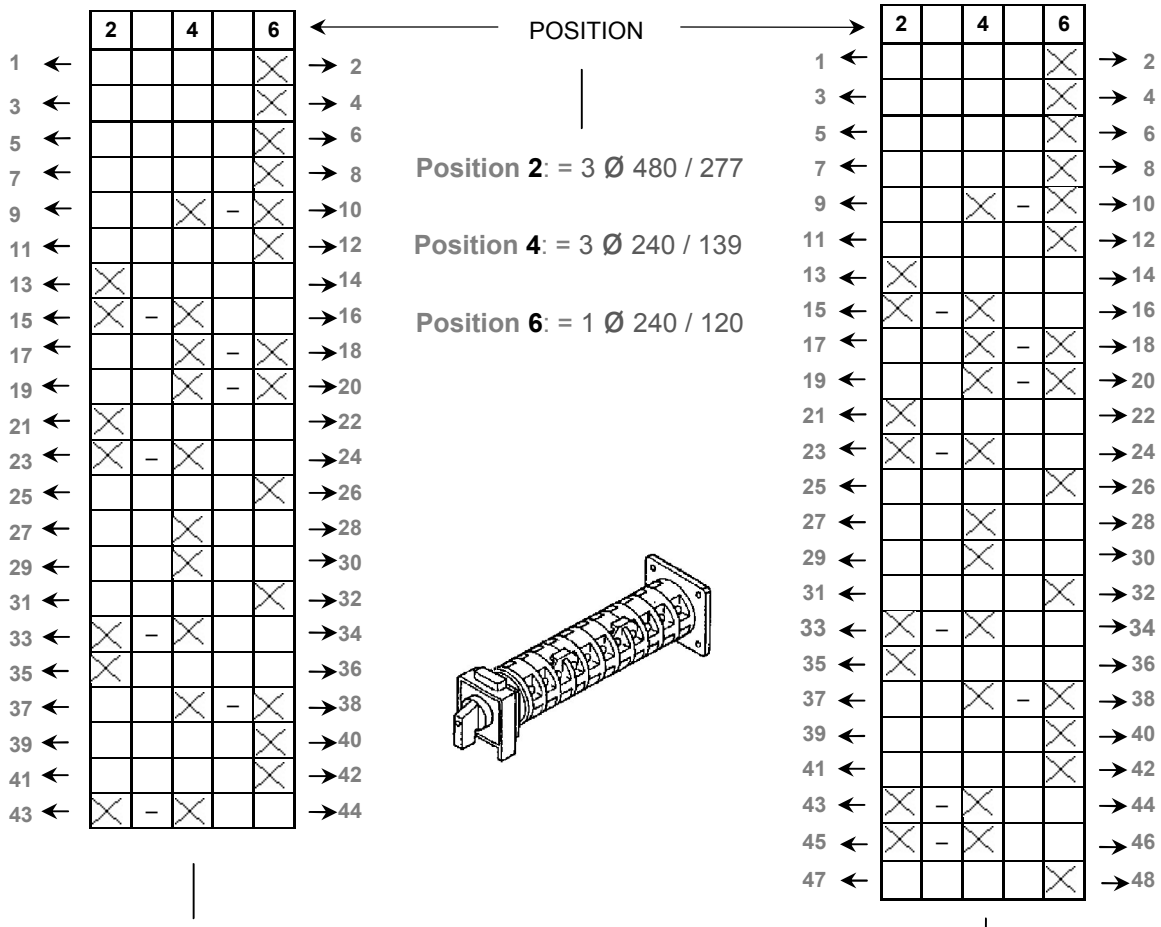



## Single Phase Zig Zag

**SINGLE PHASE**
**120V/240V**

# VOLTAGE SELECTOR SWITCH

The internal connections between terminals on the voltage selector switch are indicated by an ✕ also used are external *metal and **wire jumper connectors, see page 20 for jumper locations.




- DCA-25SSI
- DCA-45SSI
- DCA-60SSI
- DCA-70SSI
- DCA-70SSJ
- DCA-100SSJ

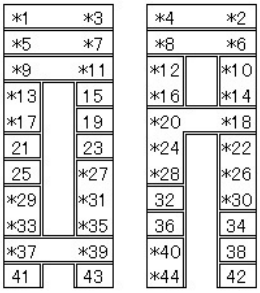
- DCA-100SSV
- DCA-125SSI
- DCA-125SSJ
- DCA-150SSI
- DCA-150SSJ
- DCA-150SSV

- DCA-25USI
- DCA-45USI
- DCA-70USI
- DCA-85USI
- DCA-125USJ
- DCA-150USJ

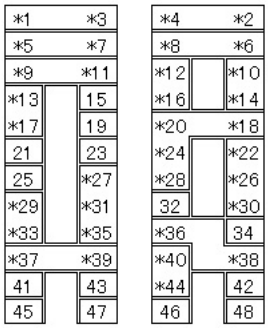
See page 20 for external jumper locations

# VOLTAGE SELECTOR SWITCH

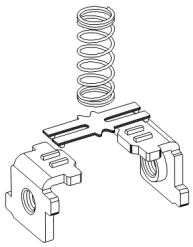
## * Metal Jumper Connections

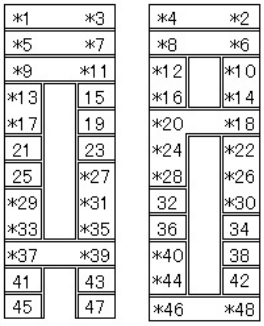



- DCA-25SSI
- DCA-45SSI
- DCA-70SSI
- DCA-100SSV

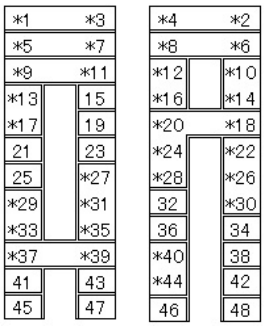



- DCA-150SSV
- DCA-150USJ



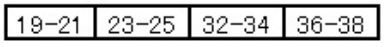



- DCA-25USI
- DCA-45USI

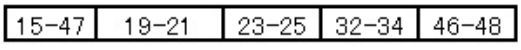



- DCA-70USI
- DCA-85USJ

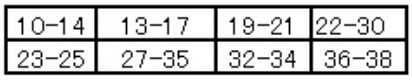
## ** Wire Jumper Connections



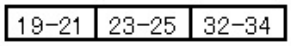

- DCA-25SSI
- DCA-45SSI
- DCA-70SSI



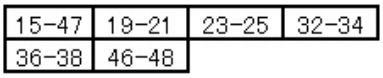

- DCA-150USJ



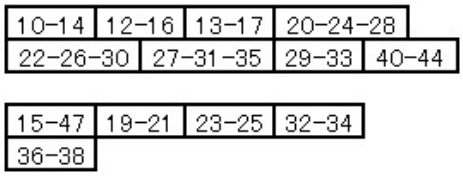

- DCA-100SSV



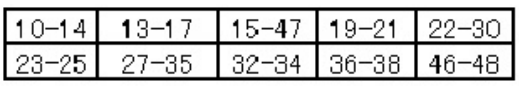

- DCA-150SSV




- DCA-70USI




- DCA-25USI
- DCA-45USI




- DCA-85USJ
- DCA-125USJ

# GENERATOR GLOSSARY

**Ammeter -** An instrument that measures electric current in amperes.

**Amperage (Amps) -** The strength of a electrical current measured in amperes.

**Armature -** That part of a generator or of an electric motor in which a current is induced by a magnetic field. The armature usually consists of a series of coils or groups of insulated conductors surrounding a core of iron. See page 8 for more information.

**Automatic Voltage Regulator (AVR) -** Increases or decreases exciter current for a more linear voltage and frequency. See open delta page 30 for more information.

**Brushless Design -** The purpose of the generator brush is to absorb power from the rotating armature of a generator and supply it to the stationary part of the generator. These brushes have a short life due to erosion. Multiquip's unique brush less design calls for lower maintenance and a longer generator life. See open delta page 30 for more information.

**Circuit Breaker (CB) -** Connects and disconnects the generator output from the output terminals. It also protects the generator from short circuits or overloads.

**Exciter Armature -** The exciter armature or just the "exciter", generates electricity which is used for excitation of the field coil. The field coil makes the magnetic field required to generate electricity, which is used for the generators main power output.

**Frequency -** Frequency is the number of complete cycles per second in alternating current direction. The standard unit of frequency is the hertz, abbreviated Hz. If a current completes one cycle per second, then the frequency is 1 Hz; 60 cycles per second equals 60 Hz

**Ground Fault Interrupters (GFI's) -** These devices are designed to eliminate electrical shock hazard resulting from individuals coming in contact with a hot AC line. The circuit interrupter is designed to sense any change in circuit conditions. It is required by the NEC that all 12 volt, single phase, 15- or 20 ampere receptacle outlets that are installed outdoors or in bathrooms have ground fault interrupters connected to them

**Heat Rise -** Is in direct relation to the longetivity of the generator. To find out why Multiquip units exceed the competition, see page 27

**KVA –** Kilo Volt Amp which sizes three phase loads can be converted to Kilowatts by multiplying the KVA by the power factor 0.8

**NEMA -** National Electrical Manufacturers Association: For more information about NEMA and their standards, visit their website at http://www.nema.org/.

**Ohm -** A unit of electrical resistance equal to that of a conductor in which a current of one ampere is produced by a potential of one volt across its terminals.

# GENERATOR GLOSSARY

**Phase -**

**Single Phase Power** (typically 120V AC or 230V AC depending on the country) is carried between two wires: live and neutral and sometimes a third ground wire for safety. The frequency of AC voltage is 50 or 60 Hz depending on the country. Single-phase power is used in very many applications, for example to power all typical home electrical appliances you use single-phase power from a normal electrical outlet at home.

**Three Phase Power** is very common and is a more efficient use of conductors. Voltage is carried through three conductors 120° out of phase with the other two. Three-phase power provides a more efficient means of supplying large electrical loads like motors, and is used more in industrial areas.

**PMG -** Permanent Magnetic Generator: Eliminates the excitation losses in the rotor, which otherwise typically represent 20 to 30% of the total generator losses. It also gives a lower temperature rise in the generator.

**Rheostat -** A continuously variable electrical resistor used to regulate current.

**Voltage -** the rate at which energy is drawn from a source that produces a flow of electricity in a circuit. Expressed in volts (V)

**Voltmeter -** This feature serves as a convenient diagnostic tool on the jobsite. The operator can quickly tell whether or not the generator is producing the correct voltage and prevent overheating of tools and equipment.

**Watt –** An international system unit of power equal to one joule per second, the power dissipated by a current of 1 ampere flowing across a resistance of 1 ohm.

| | |
|---|---|
| A = Amps | 1 Ø = Single Phase |
| W = Watts | 3 Ø = Three Phase |
| kW = Kilowatts | V = Volts |
| vA = Volt amps | dB = Decibels |
| kVA = Kilovolt amps | Hz = Frequency (hertz) |

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